

## Compilation of LPUE series of the Spanish set-longline fleet targeting hake in non-Spanish European waters

Castro<sup>1</sup>, J., D. García<sup>2</sup> and B. Patiño<sup>1</sup>

<sup>1</sup> Instituto Español de Oceanografía (IEO): [jose.castro@vi.ieo.es](mailto:jose.castro@vi.ieo.es)

<sup>1</sup> AZTI-Tecnalia



### ABSTRACT

*During the last WGHMM, a problem was identified in the assessment of northern hake in relation to the scarce information on abundance of large fish in the setting of the SS3 model. So, the inclusion of LPUEs from commercial fleets catching adults, i.e. longline or gillnet, was proposed as a possible solution to be investigated. The current working document provides the compilation of LPUE series of the Spanish set-longline fleet targeting hake in ICES Subarea VII. This fleet is compounded of vessels larger than 100 gross registered tonnes (grt) which develop a homogeneous fishing strategy targeting hake alongside the slope of the European western shelf. Although the number of hooks used by trip is not available throughout the time series, the stability of the set-longline fishing tactic makes reasonable to use fishing days as suitable effort unit.*

### INTRODUCTION

The Spanish set-longline fleet operating in non-Spanish European waters is currently composed of two fleet segments whose fishing rights were established under the “*Adhesion Treaty of Spain to the European Community*” in 1985 (Castro *et al.*, 2011). The first fleet segment is formed by vessels larger than 100 gross registered tonnes (grt) which are allowed to operate in European western waters (ICES Subareas VI and VII, and Divisions VIIIabd), and whose fishing activity is mainly focused on exploiting hake (*Merluccius merluccius*). The second fleet segment includes vessels smaller than 100 grt which are restricted to operate in non-Spanish waters of the Bay of Biscay (ICES Divisions VIIIc). Besides, these vessels develop more diverse fishing tactics exploiting not only hake but also conger (*Conger conger*) or deep-water species as forkbeards (*Phycis* spp.) and lings (*Molva* spp.).

During the last WGHMM, a number of problems were identified in the assessment of northern hake in order to be analyzed during the WKSOUTH benchmark (ICES, 2013). One of them makes reference to the little information on abundance of large fish in the present setting of the SS3 model. So, the incorporation of CPUE from commercial fleets catching adults, i.e. longline or gillnet, was proposed as a possible solution to be investigated during the benchmark. IEO has been providing to ICES landings, effort and LPUE for the Spanish set-longline fleet operating in Subarea VII for three Galician ports: Burela, Celeiro and A Coruña. However, this data was presented in annual bases, with the only objective to give LPUE series to illustrate trends of hake abundance.

Therefore, the compilation of length frequency distribution (LFD) of quarterly landings of the Spanish set-longline fleet targeting hake in ICES Division VII was developed as inter-seasonal work between WGHMM 2013 and WKSOUTH 2014 meetings.

## **MATERIAL AND METHODS**

A dataset was compiled from the commercial data sampled by IEO for the Spanish set-longline fleet operating in ICES Subarea VII: length frequency distribution (LFD), landings and effort by quarter and landing port. Four were the main ports covered, three in Northern Galicia (Burela, Celeiro and A Coruña) and one in Asturias (Avilés). This last one was irregularly covered, so the respective time series was rejected from the final compilation. Length frequency distribution could only be recovered backwards to middle 90's, so the final Spanish longline LPUE series ranges from 1995 to 2012.

## **RESULTS**

A Coruña set-longline fleet shows a pronounced decrease in effort since the beginning of the time series (2016 fishing days in 1995 to an average of 300 fd throughout the period 1998-2012), while Burela fleet shows a strong increase mainly since 2005 (Table 1; Figure 1). The Celeiro fleet seems to be stable throughout the time series (around 5000 fd average). The three fleets give similar LPUE means: 0.90 t/fd in the Burela fleet, 0.95 t/fd in the Celeiro fleet, and 0.88 t/fd in the A Coruña fleet. After combining these three fleets, the average LPUE of the recovered period (1995-2012) was 0.93 tons by fishing day (Table 2).

LPUE of hake for the Spanish set-longline fleet operating in ICES Subarea VII shows three different periods in trends (Figure 2): a stable period with an average of 0.81 t/fd throughout the first fourteen years (1995-2008), a three-year period with a marked increase of 66% (2009-2011), and a pronounced decrease (44%) in the last year (2012).

The average of quarterly landing size shows a seasonal increase: 56.3 cm, 57.1 cm, 58.4 cm and 59.8 cm from the first to the fourth quarter, respectively. The annual mean landings size also shows an increase throughout the time series, from 55.4 cm in 1995 to 61.6 cm in 2012 (Figure 3).

## **DISCUSSION AND CONCLUSIONS**

The decrease observed in the effort of A Coruña fleet started at the beginning of 90's, and it is directly related with the start of the longline fishery in Celeiro and Burela ports. This transference of vessels supports the idea to join the three ports in a common LPUE, a well as the similar LPUE mean observed in the three longline series.

It is known the importance of standardization of effort in a longline LPUE, which is strongly dependent of the number of hooks used by trip. Unfortunately, this information has never been collected, so that it is now unrecoverable throughout the time series. However, interviews with skippers describe the Spanish set-longline fishery targeting hake in European western waters as a very homogeneous fishing tactic throughout the period recovered here, without changes due to technological improvements or new management measures. Therefore tons by fishing day can be an optimal candidate of LPUE for this longline fleet. Besides, the practical lack of discards observed in this logline fleet (Pérez *et al.*, 1996) makes reasonable to use landings (LPUE) as proxy of catches (CPUE).

These longliners use an average of 90 hooks per set and 120 sets by haul (Fariña, 2013). Haul fishing starts hauling the lines between 2:00 and 4:00 pm, and begins to be collected in the morning (between 9:00 and 11:00 am). This process continues throughout the day and once completed, a new fishing haul starts. Thus it can be considered that Spanish longliners use around 10000 hooks by fishing day. Sardine, herring or mackerel are used as bait. A trip consists of about 5.3 fishing days in Subarea VII and the most common depth in the trips is located between 250 and 400 m deep.

Regarding the obtained LPUE series, the increase observed since 2009 may be related with the high recruitment calculated for 2007 and 2008 (ICES, 2013). Nevertheless, the 3 consecutive years of low recruitment do not seem to produce any decrease on the 2010-2011 LPUEs, which are still increasing. Probably related with this, the increase in the yearly mean size in the last two years of the time series makes to think that older individuals from the 2008 cohort year have been coming into the fishery until 2012, when the LPUE decrease again to the historical mean.

The increase in northern hake SSB observed in the last assessment results is considered the consequence of the 2007-2008 good recruitments as well as the high growth rate estimated by SS3 model (in agreement with the growth rate estimated from tagging data: de Pontual *et al.*, 2009). Though these recent trends are consistent with increasing landings and LPUEs, it is considered that the respective rate of variation may be over-estimated, and the inclusion of tuning information about large fish may help to stabilize the SSB estimates. The time series (1995-2012) of hake LPUE provided here for the Spanish set-longline fleet fishing in ICES Subarea VII is a good candidate to be tested in the WKSOUTH 2014.

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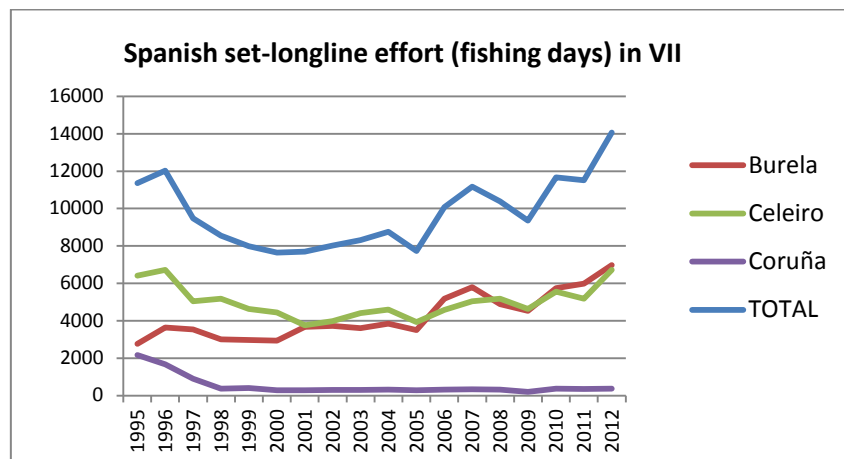
**Table 1.** Revised series of landings (t), effort (fishing days) and LPUE (t/fd) of the Spanish longline fleet operating in ICES Subarea VII by landing port: Burela, Celeiro and A Coruña.

Year	Landings (t)			Effort (fishing days)			LPUE (t/fd)		
	Burela	Celeiro	Coruña	Burela	Celeiro	Coruña	Burela	Celeiro	Coruña
1995	2273	5209	2507	2772	6420	2160	0.82	0.81	1.16
1996	3245	5988	2111	3636	6720	1668	0.89	0.89	1.27
1997	2299	4174	830	3540	5040	900	0.65	0.83	0.92
1998	1639	2817	292	3000	5184	372	0.55	0.54	0.78
1999	1982	3447	323	2964	4624	396	0.67	0.75	0.82
2000	2282	3699	281	2928	4440	276	0.78	0.83	1.02
2001	3034	3383	229	3672	3756	276	0.83	0.90	0.83
2002	2399	2841	214	3732	3984	300	0.64	0.71	0.71
2003	2514	3386	192	3612	4404	300	0.70	0.77	0.64
2004	3255	3990	280	3852	4596	312	0.85	0.87	0.90
2005	3074	4177	199	3507	3930	288	0.88	1.06	0.69
2006	3639	4372	256	5184	4572	312	0.70	0.96	0.82
2007	4367	5039	271	5796	5040	340	0.75	1.00	0.80
2008	4058	4302	233	4884	5184	324	0.83	0.83	0.72
2009	5146	4959	214	4536	4624	192	1.13	1.07	1.12
2010	9141	7630	322	5736	5556	375	1.59	1.37	0.86
2011	10908	9672	443	5988	5172	350	1.82	1.87	1.26
2012	7464	6612	218	6984	6720	363	1.07	0.98	0.60
AVERAGE							<b>0.90</b>	<b>0.95</b>	<b>0.88</b>

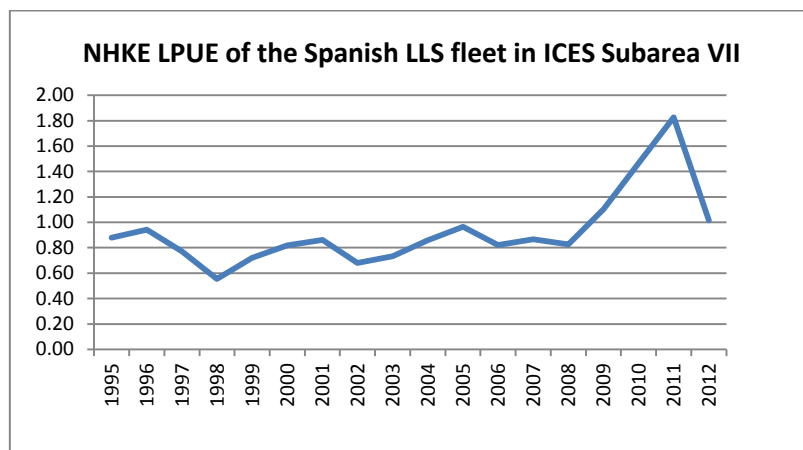
**Table 2.** Landings of hake (t), effort (fishing days) and LPUE (t/fd) of the Spanish set-longline fleet which operates in ICES Subarea VII (Burela, Celeiro and A Coruña ports together).

Year	Landings (tons)	Effort (fishing days)	LPUE (t/fd)
1995	9988	11352	0.88
1996	11343	12024	0.94
1997	7303	9480	0.77
1998	4748	8556	0.55
1999	5753	7984	0.72
2000	6262	7644	0.82
2001	6647	7704	0.86
2002	5453	8016	0.68
2003	6092	8316	0.73
2004	7526	8760	0.86
2005	7450	7725	0.96
2006	8268	10068	0.82
2007	9676	11176	0.87
2008	8593	10392	0.83
2009	10319	9352	1.10
2010	17092	11667	1.46
2011	21022	11510	1.83
2012	14294	14067	1.02
AVERAGE			<b>0.93</b>

**Figure 1.** Effort (fishing days) of the Spanish set-longline fleet operating in ICES Subarea VII: by port (Burela, Celeiro and A Coruña) and total (the three ports together).



**Figure 2.** LPUE (tons/fishing day) time series (1995-2012) of hake for the Spanish set-longline fleet operating in ICES Subarea VII.



**Figure 3.** Evolution of the hake mean landing size (cm) in the Spanish set-longline fleet operating in ICES Subarea VII.

